

BUREAU OF COMMERCIAL FISHERIES PROGRAMS

It sought "ground truth" for Gemini XII's photography

CRUISE "DELTA I" OF THE "GERONIMO"

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On November 8, 1966, the R/V "Geronimo" sailed from Galveston, Tex., for the Mississippi River Delta to acquire oceanographic

information on the sparsely sampled Delta area and to obtain "ground truth" for the photography of the Gemini XII manned space-

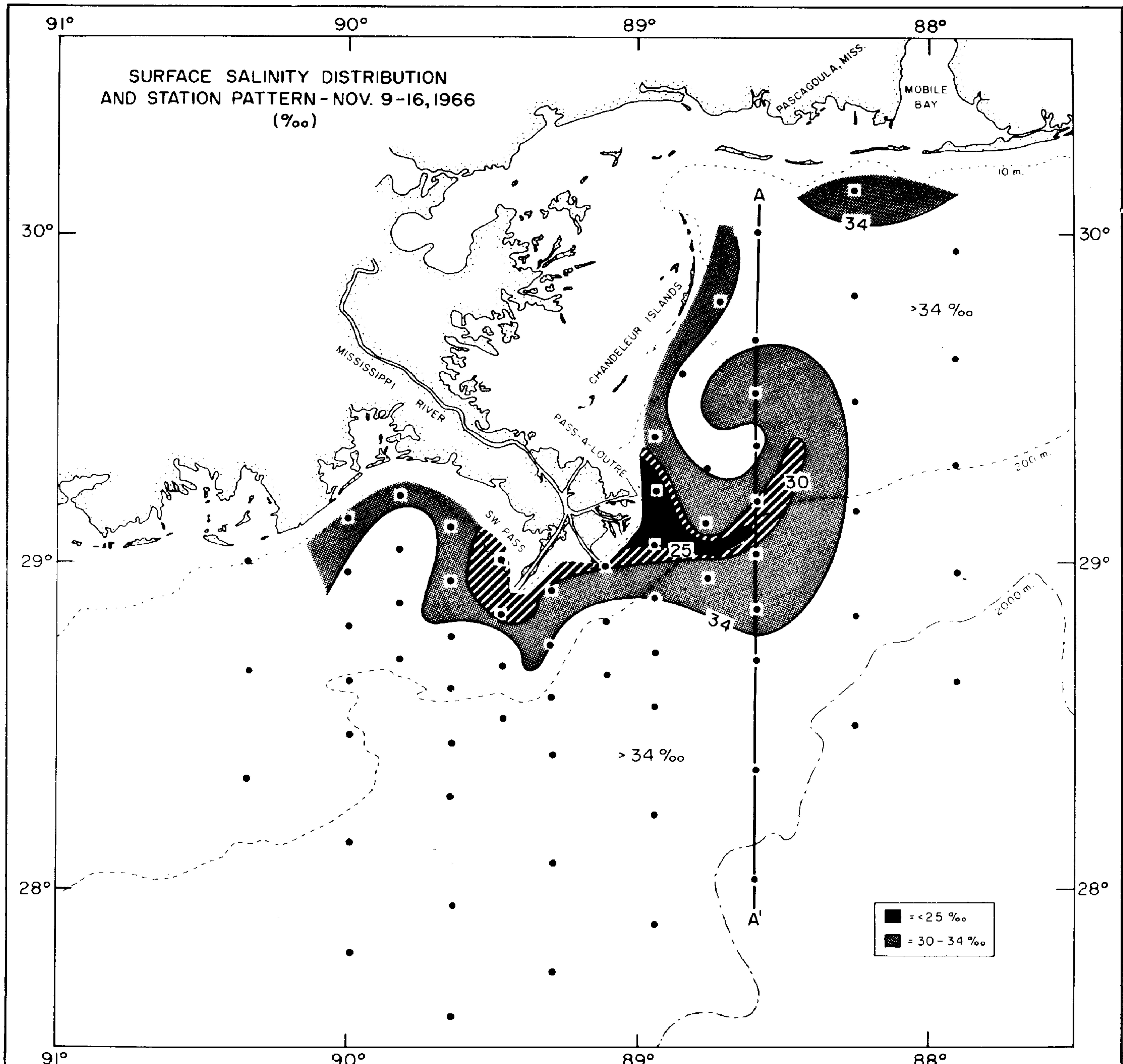


Fig. 1 - The surface salinity distribution around the Mississippi Delta, November 9-16, 1966. Note the eddy northeast of the Delta.

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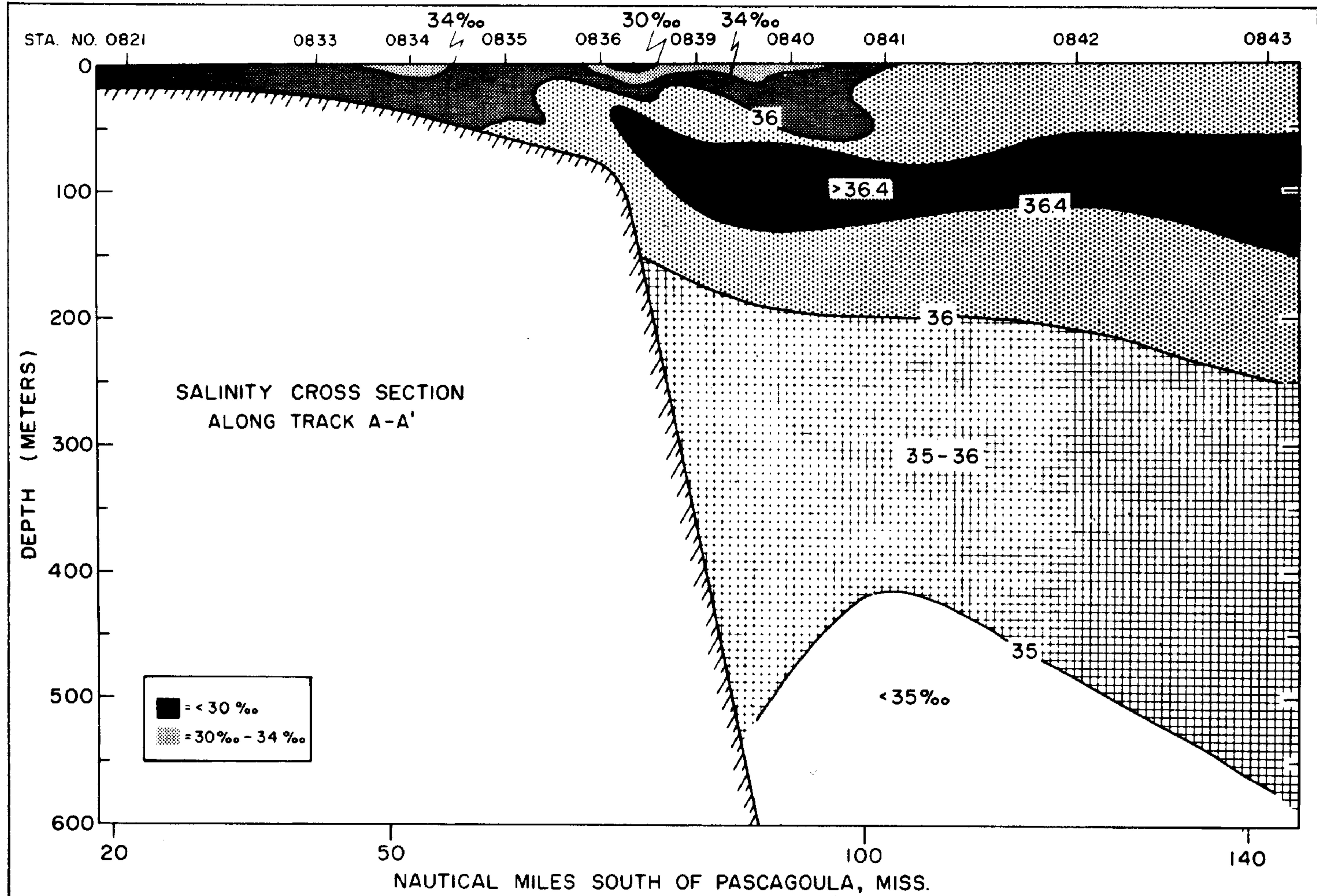


Fig. 2 - A salinity section through the eddy northeast of the Mississippi Delta. The vertical distribution around the eddy is apparent in the waters off the edge of the shelf.

flight. Cloudiness over the Delta prevented execution of the spacecraft's photographic mission, but the data gathered from the Geronimo are excellent. Because of the grid of stations, it is possible to describe features of the scale that have been observed in previous spaceflight photographs of other ocean areas.

Sixty-nine hydrographic stations were occupied from November 9-17 south of the Louisiana, Mississippi, and Alabama coasts. (See fig. 1 for station plan.) To gain an idea of the continuity in the waters, nine stations were reoccupied during the cruise.

The distribution of properties was more complex than has been reported from historical data (e.g., see Drummond and Austin, 1958, "Some aspects of the physical oceanography of the Gulf of Mexico," U. S. Fish and Wildlife Service), and is best exhibited from the salinity and oxygen content.

The salinities varied from 13.01 p.p.t. (parts per thousand) at the surface off Pass-a-Loutre to 36.7 p.p.t. at depths of 150 m. at the stations farthest offshore. In the surface distribution of salinity of figure 1, the 34-p.p.t. contour delineates the brackish, nearshore water. The 30-p.p.t. line defines the pattern of flow of the water discharged from the Mississippi River; and the 25-p.p.t. contour represents the greatest seaward extension of river water.

Water from Southwest Pass moves along two main tongues, one to the west (which curves to the southwest offshore) and the other parallel to the first but more to the south. Counterflows of oceanic water between the tongues produce rapid mixing of the brackish river water. Lesser volumes of river water flow north and east, following the coastline.

The discharge from Pass-a-Loutre splits into two flows, one to the north and the other

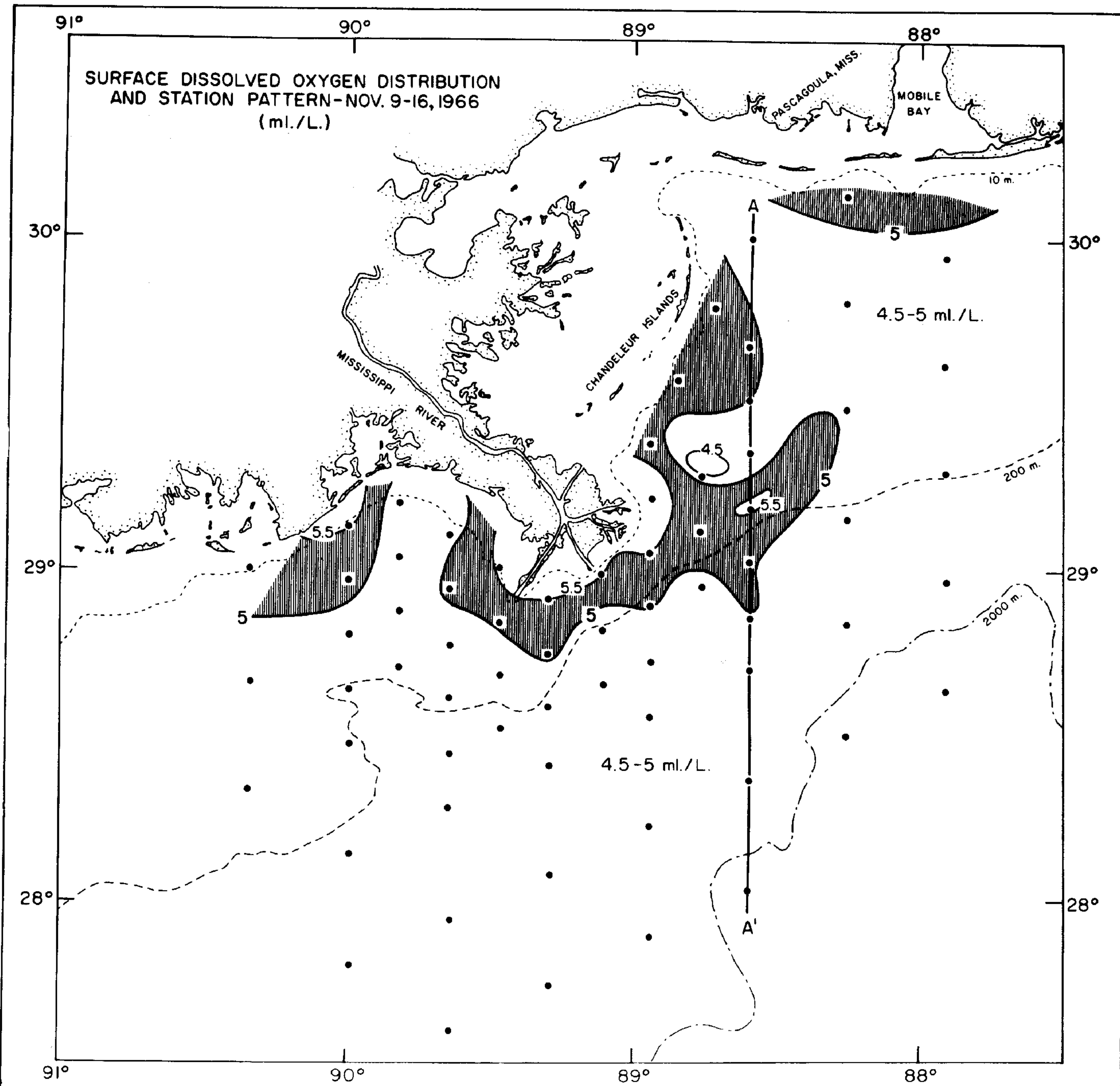


Fig. 3 - The surface oxygen distribution, November 9-16, 1966. The conformity with the salinity and the river discharge is clear. The waters with an oxygen content of 5-5.5 ml./L. are indicated by shading.

toward the southeast. The northerly flow remains nearshore. The river water that moves southeasterly feeds into a cyclonic eddy that is about 150 km. in diameter. This eddy is apparently maintained by a current that moves westerly off Mobile Bay and turns south off the Chandeleur Islands, and by a northeasterly current offshore of the Delta. The eddy is probably a semipermanent feature as these currents are at least semiprevailing circulations.

The salinity cross-section of figure 2 depicts additional features of the waters around the area of the eddy. As in figure 1, the water of < 30 p.p.t. represents the river discharge; the areas of < 34 p.p.t. represent the nearshore water and regions of > 34 p.p.t. indicate the oceanic waters. The eddy in this section is contained between stations No. 0833 and No. 0841 and the center is at about station No. 0835. Because of the cyclonic curvature, the surface water is drawn to the outside of

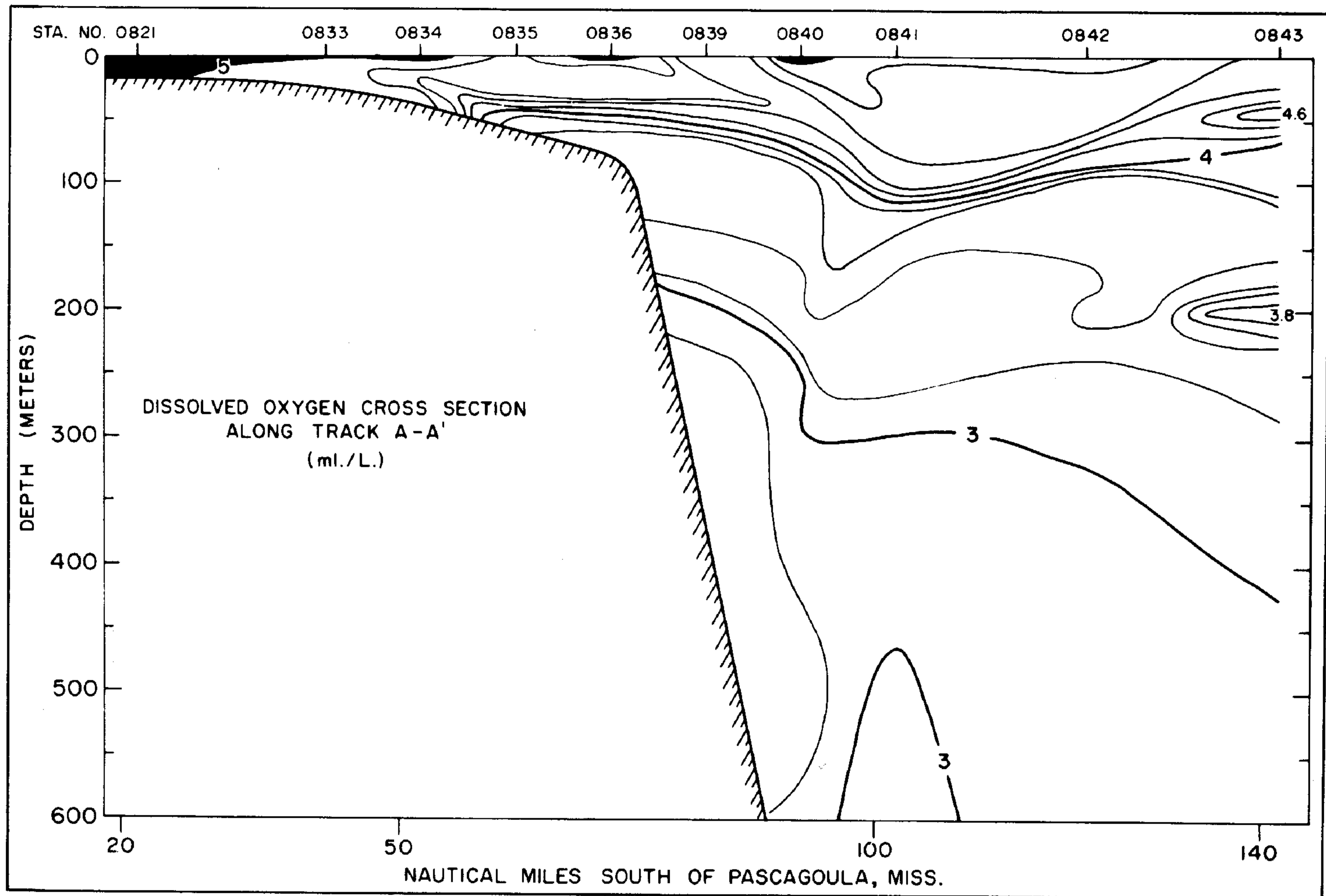


Fig. 4 - An oxygen section through the northeast eddy. The conformity with the salinity is clear.

the flow causing the surface water of <34 p.p.t. salinity to spread to the south in the southern portion and northward in the northern portion of the eddy. On the boundary of the eddy, surface water downwells between stations No. 0840 and No. 0841. Also as a result of the cyclonic curvature, subsurface water upwells in the center of the eddy.

The effects of the circulation around the eddy extend to a depth no greater than about 225 m. The deep upwelling represented by the rising 35-p.p.t. contour is probably associated with the offshore northeasterly current.

The distribution of dissolved oxygen (fig. 3) off the Delta distinctly reflects the pres-

ence of the northeast-trending eddy defined by the salinity distribution.

Around the Delta the inshore water has a gradient from 4.78 to 5.84 ml./L., at the surface. West of the Delta, however, the intrusion of a lobe of offshore water, with an oxygen content of less than 5 ml./L., is apparent. To the south of Mobile Bay, highly oxygenated water was at greater depths.

Offshore, the surface pattern of the oxygen distribution is broken by upwelling of water of lower oxygen content associated with the eddy (fig. 4). The area east of the Delta where the surface oxygen values are >5.00 ml./L. appears to coincide with the axis of the eddy.

